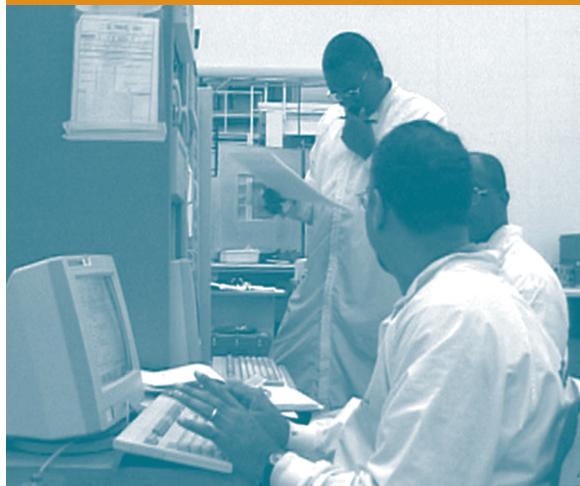


CALIFORNIA OCCUPATIONAL GUIDES



INDUSTRIAL ENGINEERS



WHAT DOES AN INDUSTRIAL ENGINEER DO?

INDUSTRIAL ENGINEERS combine solid engineering background with effective business management practices to improve quality and efficiency. Industrial Engineers recommend the best use of facilities, equipment, material, and people to make or process a product at lower cost, faster, and better. They look at the total operations process to improve work environment and safety. Industrial Engineers also concern themselves with office automation, cost-containment, and consolidation efforts.

Industrial Engineers may specialize in information technology, information systems and design, material management, logistics and distribution, plant layout and design, production planning, or work

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methods analysis. Industrial Engineers' job titles reflect the range of their assignments: business process engineer, manufacturing engineer, operations engineer, facilities engineer, plant engineer, quality engineer, reliability engineer, productivity engineer, systems engineer, ergonomist, and management engineer. Industrial Engineers work in manufacturing, government, hospitals, food processing, transportation, retail, amusement parks, and large business organizations.

Industrial Engineers plan the operations process and do the following tasks:

- Review schedules or forecasts, specifications, and customer requirements to understand what activities, and in what order, things should be done.
- Develop methods, labor utilization standards, and cost analysis systems for efficient staff and facility operation.
- Monitor workflow schedules according to established best practices to come up with improved cycle time.
- Study operations sequence, material flow, functional statements, organization charts, and project information to determine systems (labor, tools, computers) design and workplace layout.
- Apply statistical methods to determine processes, staff requirements, and production standards.
- Project system deliveries based on marketing forecasts, supply chain design, storage and handling facilities, and maintenance requirements.

Some Industrial Engineers specialize in logistics and distribution. Often, this is known as Supply Chain Management. They perform the following tasks:

- Design methods of transporting goods from one location to another. This could mean locating, designing, and building

of warehouses for large national merchandisers so their stores can be stocked on a timely basis. It could mean designing the system of trucks, rail and air to supply parts for assembly or repair (as in the auto industry).

- Design systems for handling materials from differing transportation modes and redistributing them in a minimum amount of time; for example, long haul trucks, local trucks, air cargo delivery, and containers.
- Design systems for automated replenishment of stock; such as, scanning a bar coded product in a store triggers a system that orders new stock to be delivered back to that same store.
- Design systems for the transport of people in a municipal setting, such as rail, bus, and train.
- With architects, design public facilities, such as parking garages, public transportation stations or centers, for the efficient flow and safety of people.

Some Industrial Engineers specialize in planning the layout of new facilities in manufacturing, hospitals, and government or public facilities. They perform the following tasks:

- Draft and design layout of equipment, materials, and workspace to illustrate maximum efficiency, using drafting tools and computer simulation.
- Plan and establish sequence of operations to fabricate or assemble parts or products, or service customers, and to promote efficient utilization of resources.

Quality control is often a responsibility of Industrial Engineers. They perform the following tasks:

- Coordinate quality control objectives and activities to resolve production problems, increase product reliability, and minimize cost with partners around the world.
- Analyze statistical data and product specifications to establish quality and reliability objectives of finished product.
- Formulate sampling procedures and forms for recording, evaluating, and reporting quality and reliability data.
- Implement methods for disposition of defective material or parts, and assesses cost and responsibility.

- Estimate production cost and effect of product design changes for management review, action, and control.
- Record or oversee recording of information to ensure currency of engineering drawings and documentation of production problems.
- Direct workers engaged in product measurement, inspection, and testing activities to ensure quality control and reliability.

WHAT SKILLS ARE IMPORTANT?

Important skills, knowledge, and abilities for Industrial Engineers include:

- Engineering and Technology – Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- Production and Processing – Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- Mathematics – Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- Administration and Management – Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- Written Comprehension – The ability to read and understand information and ideas presented in writing.
- Oral Expression – The ability to communicate information and ideas in speaking so others will understand.

Communication skills are critically important to gather information and effectively present findings and recommendations. Industrial Engineers train people in new processes and procedures and must convince them of the importance and efficacy of these new methods. They work closely with employees in all types of jobs, equipment and material suppliers, and the firm's customers.

Industrial engineering will appeal to those who enjoy working with ideas, solving problems, and starting and carrying out projects that involve leading people and making decisions. It will also appeal to those who like working closely with other people.

WHAT'S THE WORK ENVIRONMENT?

Industrial engineering is not physically demanding, but frequently takes the engineer out of the office into production and manufacturing areas. Today, this often means traveling across the country or around the world to the manufacturing site. Industrial Engineers spend much of their time asking questions. They may talk with production workers, as well as technical or administrative staff. It is not unusual for these Engineers to be involved in several projects at once. Therefore, they must be flexible enough to drop one project and pick up another at a moment's notice. Management uses much of an Industrial Engineer's output for making decisions. Their work must be accurate as their recommendations may affect production costs, labor relations, and its profits. Because of this, stress may be considerable at times.

Union Membership

Nationally, fewer than 19 percent of all types of engineers belong to unions. Most engineers who belong to unions work in government or higher education according to the Bureau of National Affairs' report, Union Membership and Earnings: Compilations from the Current Population Survey, 2001 and 2003 editions.

WHAT'S THE CALIFORNIA JOB OUTLOOK?

The following information is from the occupational projections produced by the Employment Development Department (EDD) Labor Market Information Division (LMID):

Industrial Engineers

Estimated number of workers in 2002:	18,600
Estimated number of workers in 2012:	20,800
Projected Growth 2002-2012:	11.8%
Est. openings due to separations by 2012:	4,500

These figures do not include self-employment.

This occupation will grow slower than average compared with all occupations in California. Industrial Engineers will average 460 job opportunities per year including occupational growth and replacing those who permanently leave the occupation.

Trends

The emphasis on increased productivity supports economic growth and requires the expertise of Industrial Engineers. More and more industries outside of manufacturing use the skills of Industrial Engineers.

WHAT DOES THE JOB PAY?

California Earnings

The following information is from the Occupational Employment Statistics Survey of Employers by EDD/LMID:

Industrial Engineers 2005 Wages

Hourly wages range from	\$30.00	to	\$44.98
Average hourly wage	\$37.69		
Average annual wage	\$78,388		

These figures do not include self-employment.

Hours

Industrial Engineers generally work a 40-hour, five-day week and are expected to work overtime when necessary to meet project deadlines.

Benefits

The benefit package available varies by industry and employer.

HOW DO I PREPARE FOR THE JOB?

Education and Training

A bachelor's degree in Industrial Engineering or a related engineering degree is almost always necessary for entering this occupation. In addition, many employers will hire only those who have at least two years' successful experience in this field. Eight California universities offer degrees in industrial engineering accredited by the Accreditation Board for Engineering and

Technology (ABET). High school students should take advanced mathematics and science courses to prepare for pursuing a college degree in Industrial engineering. Electives in electronics, business administration, and computer science will provide valuable background for a successful career in industrial engineering. Industrial Engineers planning careers in management find that obtaining a master's degree in business administration (MBA) is helpful.

To locate educational programs for Industrial Engineers use www.cpec.ca.gov/collegeguide/collegeguide.asp.

Licensing and Certification

Engineers working for government agencies or whose work may affect the public welfare are required to be registered by the State. To obtain registration, engineers must pass the Engineer-in-Training examination, obtain at least two years of engineering experience (without a bachelor's degree in Industrial Engineering, six years of experience is required), and then pass the professional examination in industrial engineering. While registration is not required for all jobs, a registered engineer will have a competitive edge for advancement to more responsible positions.

Continuing Education

The role of Industrial Engineers as leaders of continuous improvement mandates they keep up to date on the latest technical and management methodologies.

HOW DO I FIND THE JOB?

Direct application to employers remains one of the most effective job search methods. Professional associations provide opportunity for meeting leaders in the field. Industrial Engineers work in manufacturing industries and service industries. Eight industries in California each employ more than 1,000 Industrial Engineers.

- Electronic Components and Accessories
- Computer and Data Processing Services
- Aircraft and Parts

- Search and Navigation Equipment
- Measuring and Controlling Devices
- Computer and Office Equipment
- Motion Picture Production and Services
- Engineering and Architectural Services

Industrial Engineers also work for government, hospitals, and business services.

Search these **yellow page** headings for listings of private firms:

- Engineers-Industrial
- Engineers-Consulting
- Engineers-Manufacturing
- Hospitals
- Insurance Companies
- Public Utilities

The following Internet resources can be helpful to the job search process:

America's Career InfoNet
www.acinet.org

America's Job Bank
www.ajb.dni.us

CalJOBSSM
www.caljobs.ca.gov

Job Search and Resume Writing
www.worksmart.ca.gov/success_tips_menu.html

Local Job Service Offices
www.edd.ca.gov/jsrep/jsloc.htm

Occupational Information Network (O*NET) Online
<http://online.onetcenter.org>

One-Stop Career Centers List
www.edd.ca.gov/ONE-STOP/pic.htm

For statewide and local projections, wages, employers by county, and other occupational information go to www.labormarketinfo.edd.ca.gov and select *Find an Occupation Profile*.

Use the Locate Potential Employers feature of **Career One Stop** to locate specific employers by industry, occupation, and geographic location. For resume writing and job search tips, visit **WorkSmart**.

WHERE CAN THE JOB LEAD?

Recently graduated engineers usually begin their careers as assistant engineers. As they gain experience, they may advance to associate and senior level positions. Industrial Engineers' role as a conduit between production and management can lead to management positions.

OTHER SOURCES OF INFORMATION

Board for Professional Engineers
and Land Surveyors
2535 Capitol Oaks Drive, Suite 300
Sacramento, CA 95833-2926
(916) 263-2222
www.dca.ca.gov/pels/index.html

Institute of Industrial Engineers
3577 Parkway Lane, Suite 200
Norcross, GA 30092
(800) 494-0460
www.iienet.org

Society of Manufacturing Engineers
International Headquarters
One SME Drive
Dearborn, MI 48121
(800) 733-4763
www.sme.org

Manufacturing Is Cool...
www.manufacturingiscool.com

Accreditation Board for Engineering
and Technology (ABET)
111 Market Pl., Suite 1050
Baltimore, MD 21202
(410) 347-7700
www.abet.org/faq.html

RELATED OCCUPATIONAL GUIDES

Mechanical Engineers	No. 5
Electrical/Electronics Engineers	No. 12
Civil Engineers	No. 39
Production Planners	No. 271

OCCUPATIONAL CODE REFERENCES

SOC (<i>Standard Occupational Classification</i>)	
Industrial Engineers	17-2112
O*NET (<i>Occupational Information Network</i>)	
Industrial Engineers	17-2112.00
OES (<i>Occupational Employment Statistics</i>)	
Industrial Engineers, except safety	22128